Total laparoscopic suprarenal aortic coral reef removal

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Symptomatic suprarenal coral reef aortic lesions have a poor natural history and threaten visceral and lower extremity perfusion. We report our experience with total laparoscopic suprarenal aortic coral reef removal in three patients, aged 46, 48, and 52 years. Coral reef lesions were associated with aortoiliac occlusive lesions in two cases. One patient had an associated thoracic coral reef lesion. Patients underwent total laparoscopic coral reef removal combined with laparoscopic aortobifemoral bypass in two cases and open thoracic coral reef removal in one case. Postoperative courses were uneventful. All patients were alive with patent revascularization after a mean follow-up of 38 months, 29 months, and 1 month. (J Vasc Surg 2006;44:194-7.)

Suprarenal coral reef aorta lesions are uncommon. Surgical treatment is recommended because of the poor natural history of symptomatic lesions, which threaten digestive, renal, or lower extremity perfusion. Transaortic endarterectomy is accepted as a standard repair that is usually performed through an extensive thoracoabdominal approach.[1-7] Removal of the coral reef lesion often necessitates a simple atherectomy. Endarterectomy is in fact performed for extensive lesions, especially when they extend into visceral arteries. Taking advantage of our experience with videoscopic aortic surgery,[8-10] we performed a total laparoscopic removal (TLR) for suprarenal coral reef lesions in three patients. We discuss the technical points and main advantages of this new surgical approach.

CASE REPORTS

Case 1. A 46-year-old man presented with bilateral lower limb rest pain. Four years previously, he had undergone right common iliac artery stenting. Aortography showed stent occlusion that extended into the aortic bifurcation and caused significant left common iliac artery narrowing. The lateral view showed a large filling defect projecting off the posterior suprarenal and interrenal aortic wall and preserving visceral and renal arterial patency. Computed tomographic (CT) scan showed a coral reef lesion appearance. The patient was classified in accordance with the American Society of Anesthesiologists (ASA) as class II and had a body mass index of 17.4 kg/m^2. The patient was scheduled for total laparoscopic aortobifemoral bypass with TLR of coral reef lesions, for which he gave informed consent. The laparoscopic aortic approach was obtained with a left retrocolic dissection conducted in line of the Toldt fascia. The upper abdominal aorta was approached

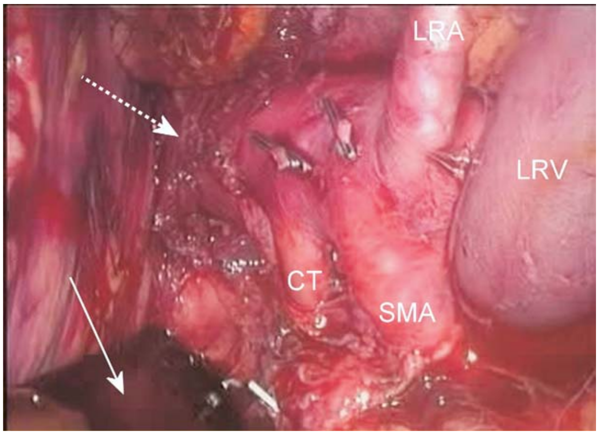

Fig 1. Intraoperative view showing laparoscopic exposure of the celiac aorta and visceral arteries through a transperitoneal left partial medial visceral rotation. *Arrow,* Retractor behind the pancreas; *dotted arrow,* divided left crus of the diaphragm; *CT,* celiac trunk; *SMA,* superior mesenteric artery; *LRA,* left renal artery; *LRV,* left renal vein.

through laparoscopic limited left medial visceral rotation, and the spleen was left in situ[5] (Fig 1). After systemic heparinization, bulldog clamps were applied to the visceral arteries. Supraceliac proximal aortic laparoscopic cross-clamping (Storz-France SA, Paris, France) was performed. Longitudinal aortotomy began below the renal arteries and extended up and left of the visceral arteries. The coral reef lesion was removed by using laparoscopic grasping forceps. The aortotomy was closed by using a continuous 4-0 polypropylene suture. Bulldog clamps were removed, and a proximal aortic clamp (Storz-France SA) was re-placed below the renal arteries to restore visceral perfusion. Laparoscopic aortobifemoral bypass was performed according to the technique previously described.[8,10] The postoperative course was uneventful. Perioperative data are summarized in the Table. Bypass and suprarenal aorta remained patent at 38 months' follow-up on CT scan and duplex studies.

Case 2. A 48-year-old man presented with bilateral intermittent claudication. Aortography showed two coral reef lesions:

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Table. Perioperative data

Variable	*Patient 1*	*Patient 2*	*Patient 3*
Operating time (min)	390	350	150
Supravisceral clamp time (min)*	28	24	28
Proximal aortic clamp level	Supraceliac	Interceliomesenteric	Supraceliac
Body temperature (°C)	37.4	37.1	37.2
Blood loss (mL)	500	800	300
Return to general diet (d)	2	3	2
Ambulation (d)	3	10	3
ICU stay (d)	5	5	1
Length of stay (d)	11	19	8
Follow-up (mo)	38	29	1

ICU, Intensive care unit.
*Time elapsed between proximal aortic clamping and unclamping of the suprarenal aorta.

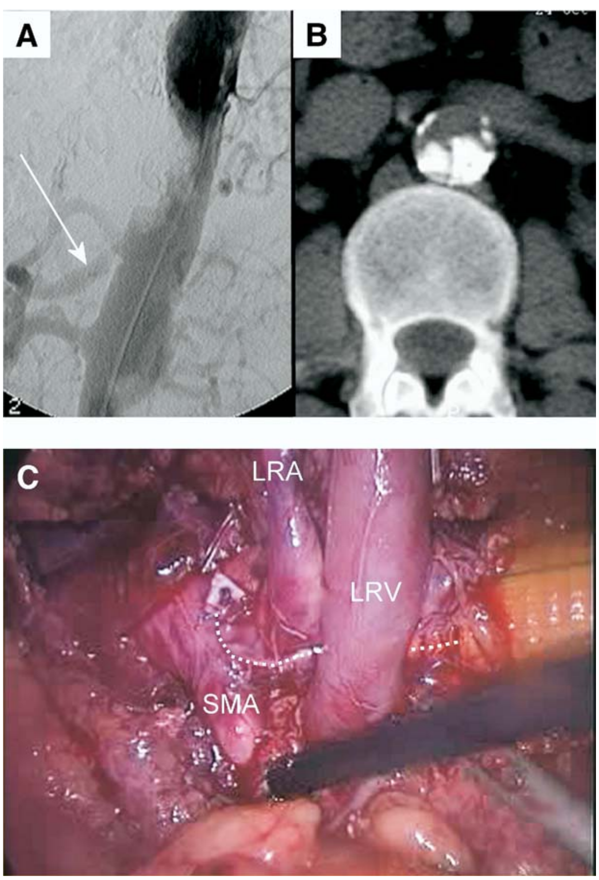
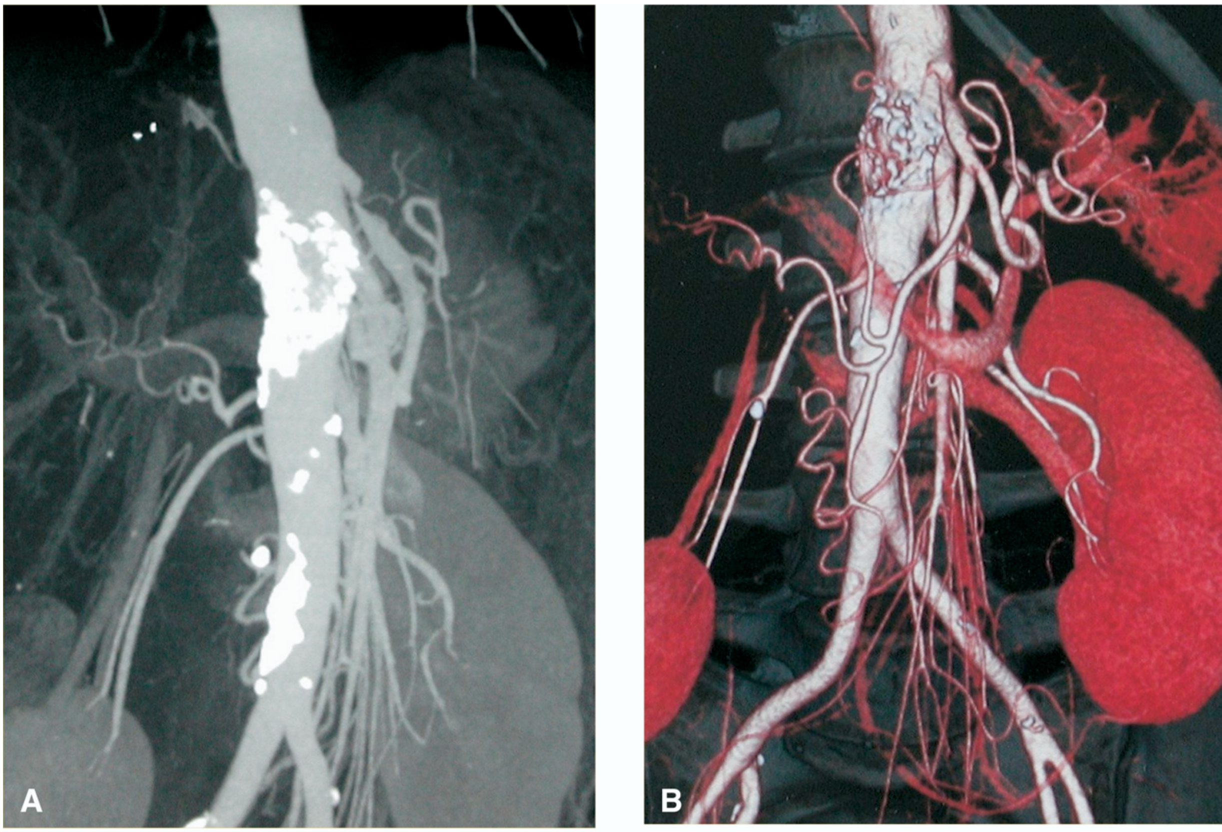


Fig 2. Preoperative lateral aortogram (*arrow,* celiac trunk) (**A**) and contrast-enhanced computed tomographic scan (**B**) showing partial luminal filling with the calcified material. (**C**) Intraoperative view after coral reef removal showing the suprarenal aortic suture and infrarenal graft implantation. *Dotted line,* Suture line of the suprarenal aortotomy; *SMA,* superior mesenteric artery; *LRA,* left renal artery; *LRV,* left renal vein.

one in the suprarenal area and the other above the celiac trunk (Fig 2, *A*). Extensive aortoiliac occlusive disease was associated with these. CT scan showed subocclusion of the aorta related to the calcified plug (Fig 2, *B*). The patient was ASA class II with a body mass index of 24.4 kg/m^2. He gave informed consent for coral reef lesion endarterectomy and aortobifemoral bypass. The scheduled procedure combined TLR of the suprarenal coral reef lesion, total laparoscopic aortobifemoral bypass, and open endarterectomy of thoracic lesions. The operation began with laparoscopic upper abdominal aorta exposure, as previously described for patient 1. Interceliomesenteric proximal aortic laparoscopic cross-clamping (Storz-France SA) was performed. The aorta was transected 2 cm below the renal arteries and passed over the left renal vein. A longitudinal aortotomy was conducted medially and beyond the left renal artery to the lateral side of the superior mesenteric artery. Coral reef lesions were removed with a laparoscopic grasping forceps, and the aortotomy was repaired with a 4-0 polypropylene running suture. A proximal clamp (Storz-France SA) was then re-placed below the renal arteries. Laparoscopic aortobifemoral bypass was then performed according to the technique previously described[8,10] (Fig 2, *C*). After closure of groin and port incisions, patient was placed in the right lateral decubitus position, and the thoracic coral reef lesion was removed through a conventional left posterolateral thoracotomy in the eighth intercostal space. Open surgery was preferred to avoid a prolonged thoracic clamping time and the subsequent risk of medullar ischemia. The postoperative course was uneventful. Other perioperative data are summarized in the Table. The aortobifemoral bypass and the sites of coral reef removal remained patent at 29 months' follow-up on CT scan and duplex studies.

Case 3. A 52-year-old woman presented with bilateral intermittent claudication and chronic mesenteric ischemia. The CT scan showed a subocclusive coral reef lesion of the visceral aortic segment, which developed from the right and posterior side of the aorta and protruded into the ostia of superior mesenteric and left renal arteries (Fig 3, *A* and *B*). The main right renal artery was occluded. A right polar renal artery remained patent. The patient was ASA class II with a body mass index of 17 kg/m^2. She was scheduled for TLR of the coral reef, for which she gave informed consent. Upper abdominal exposure was obtained with a laparoscopic left retrorenal approach.[7,8] Supraceliac proximal aortic cross-clamping (Storz-France SA) and infrarenal distal cross-clamping were performed. A curved and longitudinal aortotomy posterior to the visceral branches exposed the coral reef lesion, which was removed with a grasping forceps (Storz-France SA; Fig 3, *C*). Appropriate desobstruction of the visceral ostia was



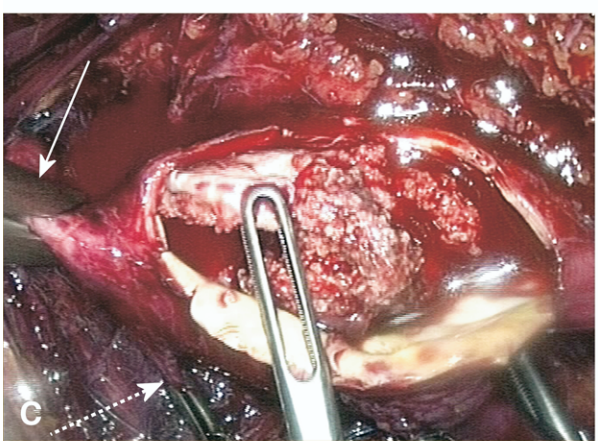


Fig 3. Preoperative computed tomographic scan view showing the celiac coral reef protruding into the visceral arteries (**A**) with occlusion of the main right renal artery (**B**). (**C**) Intraoperative view showing removal of the coral reef with laparoscopic grasping forceps. *Arrow,* Proximal supraceliac aortic clamp; *dotted arrow,* celiac trunk controlled with a bulldog clamp.

achieved. The aortotomy was then closed with a continuous 4-0 polypropylene running suture. Perioperative data are summarized in the Table. The postoperative course was uneventful. The visceral aortic segment was patent at 1 months' follow-up on CT scan and duplex studies.

DISCUSSION

Atherectomy with or without endarterectomy is recognized as the treatment of choice for suprarenal aorta coral reef lesions, but this necessitates an extensive surgical approach.[1-6] A thoracoabdominal incision is often performed to obtain a complete exposure of the infrarenal and suprarenal aorta.[5,7] This approach is associated with substantial postoperative morbidity and surgical stress related to thoracotomy, diaphragm division, and exposed viscera.

The objective of laparoscopy is to decrease operative trauma by avoiding large abdominal or thoracoabdominal incisions. These three cases show that TLR for suprarenal aortic coral reef lesions is feasible. As reported in the two first cases, it can be combined with total laparoscopic infrarenal aortic bypass. The main challenges of TLR for suprarenal aortic coral reef lesions are clamping time, either supraceliac or suprarenal, and distal control of the endarterectomy in the visceral arteries. The two main technical points that allow overcoming these challenges are the quality of aortic exposure and skill in videoscopic suturing. A laparoscopic approach to the suprarenal aorta is possible via a transperitoneal route (either retrocolic or retrorenal). However, with growing experience, we consider that the transperitoneal retrorenal approach is the technique of choice when suprarenal dissection and clamping are necessary.[8] Unlike with the retrocolic approach, exposure of the abdominal aorta is not hampered by the left renal vein. With the section of the left crus of the diaphragm, exposure of the suprarenal aorta is wide and stable during the performance of endarterectomy and suturing. In our three cases, suprarenal clamping times were acceptable and were close to those observed with conventional surgery. The second main challenge of TLR is end-point control of endarterectomy in the visceral arteries. In our cases, coral reef lesions developed from the posterior wall of the aorta protruding into the ostia of the visceral arteries. Videoscopic end-point control of endarterectomy was easy but could have been impossible in cases of extension in visceral arteries trunks. Selection of patients is therefore essential before laparoscopic removal; patients should be excluded when coral reef lesions extend into the visceral arteries. For such patients, open repair with endarterectomy of the visceral arteries remains the technique of choice.

Satisfying postoperative outcomes in our three cases will encourage us to offer TLR of suprarenal coral reef lesions in most cases. However, we are aware that it remains technically demanding and that previous experience in total laparoscopic aortic surgery is essential. It is important to remember that in cases of intraoperative difficulties, a conversion to open repair is always possible.

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